Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Cryogenic Infrared Nano-Imaging of the Metal-Insulator Transition in V_2O_3 A.S. MCLEOD, University of California San Diego, E. VAN HEUMEN, University of Amsterdam, BRIAN C. CHAPLER, M.D. GOLDFLAM, M.K. LIU, L. ANDEREGG, SIMING WANG, J.G. RAMIREZ, S. GUENON, IVAN K. SCHULLER, D.N. BASOV, University of California San Diego — We report on temperature-dependent (18K-300K) near-field infrared imaging of the canonical Mott insulator V_2O_3 across its temperature-driven metal-insulator transition. This was accomplished using a home-built s-SNOM (scattering-type scanning near-field optical microscope) affording unprecedented spatial sensitivity ($\approx$20 nm) to surface optical properties with simultaneously acquired AFM topography at *cryogenic temperatures*. Our V_2O_3 thin film is found to exhibit extreme nano-scale electronic heterogeneity near the Mott transition (170K) from paramagnetic metal to antiferromagnetic insulator. Through a sequence of near-field infrared images acquired across the transition, we resolve dynamic spatial correlations and competition between electronic phases, offering a direct probe of the metal/insulator fill fraction in strong agreement with macroscopic transport, magnetic susceptibility, and X-ray diffraction measurements of the same film. A statistical and tomographic analysis of our near-field images supports the interpretation of a complex 3-dimensional network of phases propagating across the Mott transition.

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Date submitted: 13 Nov 2013 Electronic form version 1.4